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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/752,416	01/06/2004	David G. Mikolas	100116	3899

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EXAMINER	
NGUYEN, GEORGE BINH MINH	
ART UNIT	**PAPER NUMBER**
3723	

DATE MAILED: 05/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/752,416	MIKOLAS ET AL.	
	Examiner	Art Unit	
	George Nguyen	3723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 March 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12 and 14-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 14-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *March 03, 2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Receipt is acknowledged of Applicant's amendment filed on March 03 ,2005.

Claim 13 was canceled. Claims 1-12 and 14-18 are presented for examination.

Receipt is acknowledged of the IDS filed on March 03, 2005 which has been considered and placed of record in the file.

Drawings

1. The drawings were received on March 03, 2005. The drawing is Fig. 5B which is acceptable to the examiner.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

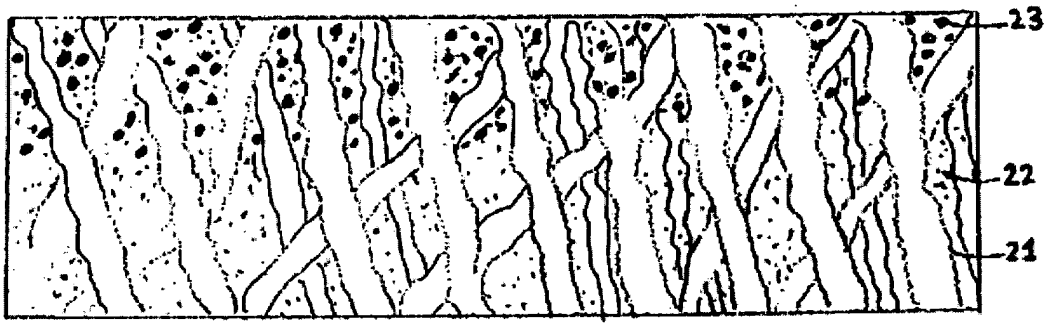
> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-12 and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker, III et al.'6,626,740.

With reference to Figure 2, col. 2, 3 and 8 as shown below discloses the claimed invention. Please note that the prior art "dub-off" (col. 10, lines 15-20) is interpreted as "corner rounding". Furthermore, the prior art inherently teaches the "selectively polishing" in order to achieve the improved "dub-off". However, Baker does not disclose that the structure includes a highest point and a lowest point ... 0.5 microns or greater as set forth in the claims. It is noted that this height differential refers to the condition

before the polishing begins because "the structure" refers to "a structure" in the preamble.

FIGURE 2A



Hardness or compression modulus of the polishing pad is a measure of the degree to which the pad material deforms when subjected to pressure or downforce during CMP. Hard polishing pads generally yield a polished substrate surface with good planarization and low form error. However, hard polishing pads also scratch the substrate surface and result in a polished substrate surface of poor quality. Soft polishing pads, such as poromeric pads, and "foam" type pads, generally exhibit excellent surface finish with low levels of scratching, low roughness and good removal rates. However, soft polishing pads result in poor planarization and high waviness of the polished substrate surface. The present invention combines desirable characteristics of hard and soft polishing pads resulting in a finished polished substrate surface with low roughness, low waviness, low dub-off and minimal scratching.

The pad of this invention comprises a soft layer with a porous structure impregnated with a hard material. Under polishing pressure, the hard material locally deforms irreversibly to a substantially flat polishing pad surface resulting in a polished substrate surface with relatively high planarity and substantially low form error. In an embodiment, the soft layer comprises a polymeric material having a glass transition temperature up to about 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, or 50° C. and the relatively hard material comprises a polymeric material having a glass transition temperature in a range of about 25° C. to 175° C., including 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170 or 175° C. In an embodiment, the relatively hard material is a polymeric material having a glass transition temperature in a range of about 40° C. to about 110° C. Typical temperatures observed during CMP are in a range of about 20° C. to 40° C. The relatively hard polymeric material has a glass transition temperature relatively higher than the ambient temperature during polishing making it brittle and readily friable. Thus, the hard polymeric material is capable of being locally deformed irreversibly to a substantially flat polishing pad surface. In another embodiment, the soft layer is coated

spots on the polishing pad surface and bubbles under the polishing pad, often resulting in a non-uniform polishing pad surface and inconsistent polishing performance of the polishing pad during CMP. Thus, a need exists for polishing pads that exhibit consistent polishing behavior.

The substrate surface can be characterized by surface features that repeat at a specified distance or spatial wavelength. The overall shape characteristics of the substrate surface can be collectively referred to as "form" of the substrate surface. High and low spots on the substrate surface are often linked to form error, since they represent peaks and valleys on the substrate surface relative to an imaginary reference plane (corresponding to an ideally flat surface), as illustrated in FIG. 1A. Flatness is a measure of the peak to valley range from the imaginary reference plane over long spatial wavelengths. Another parameter to be minimized during CMP is dub-off. Dub-off (also referred to as roll-off in the memory disk industry) is the "negative deviation from the nominal surface extending from the chamfer and continuing to the edge of the flyable zone (International Disk Equipment and Materials Association)", illustrated in FIG. 1B. Two measurements are used to quantify dub-off: peak and radius of curvature. The peak measurement identifies the maximum distance of the polished surface from a fit line designated by the instrument technician. Similarly, the radius of curvature measurement is the distance from the surface being measured to the center of curvature.

onto a flexible substrate. In an embodiment, the porous structure of the soft layer enables movement of polishing fluid or slurry during CMP. This ability to transport the polishing fluid or slurry enables uniform wetting of the polishing pad of this invention resulting in consistent removal rates.

The pad of this invention is capable of being locally deformed irreversibly to a substantially flat polishing pad surface when the readily friable hard material cracks at the high spots under polishing pressures resulting in a substantially flattened polishing pad surface. Thus, the pad of this invention has a "self-leveling" characteristic or nature which results in a polishing pad that is tolerant to mounting irregularities and can improve waviness and flatness of the polished substrate surface.

The soft material has a porous structure that is either self-supporting or is coated onto a flexible substrate such as a flexible metal film, polyester film, or a foam. The soft layer is impregnated with a hard, friable material. During polishing the substrate being polished (workpiece) flexes the polishing pad so that the hard material cracks and breaks down in any high spots on the polishing pad surface. Further down in the pad surface the flexing is insufficient to cause any disruption to the hard material. Thus, the polishing pad surface becomes substantially flat during polishing creating a "self-leveling" surface. The soft layer controls the final finish of the polished substrate surface while the hard material controls the form error (waviness) of the polished substrate surface.

The "self-leveling" characteristic of the polishing pad of this invention results in a flat polishing pad surface, improving product yields during CMP by reducing aberrations in the surface of the polished substrate or workpiece. Thus, the pad of this invention has the following advantages when used for CMP: 1) elimination of inconsistencies during pad manufacturing and inconsistencies during the process of mounting the polishing pad on a platen of a polishing machine; 2) improved long wavelength roughness; and 3) higher removal rate with minimal scratching of the polished substrate surface. The pad of this invention is used to polish semiconductor devices, silicon wafers, glass disks, LCD screens, memory disks, or the like.

ing to this invention. In chemical-mechanical polishing of semiconductor substrates, the substrate is pressed against a polishing pad and a polishing fluid or slurry is provided at the interface between the substrate and the polishing pad while the polishing pad and the substrate are moved relative to each other under pressure. Polishing pressure or downforce controls the polishing rate or the material removal rate from the substrate being polished. A higher downforce results in faster material removal rate from the substrate with scratching while a lower downforce yields lower material removal rates but a polished surface of better quality since the abrasive particles in the slurry do not scratch the substrate surface to the same extent at lower downforce values as at higher downforce values. During CMP, the substrate (for e.g. glass disks, semiconductor wafers, multi-chip modules or printed circuit boards) to be polished is mounted on a carrier or polishing head of the polishing apparatus. The exposed surface of the substrate is then placed against the rotating polishing pad. The carrier head provides a controllable pressure (or downforce), on the substrate to push it against the polishing pad. A polishing fluid with or without abrasive particles is then dispensed at the interface of the substrate and the polishing pad to enhance material removal from the substrate surface. Typical downforce values during CMP are in a range of about 0.7 kPa to about 70 kPa.

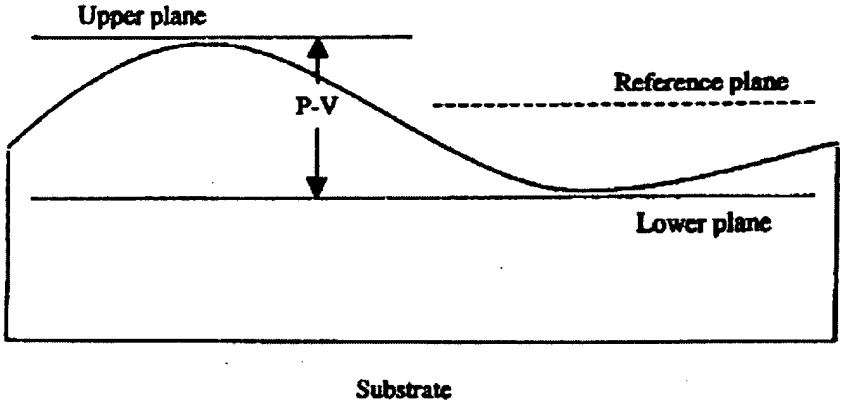


FIGURE 1A

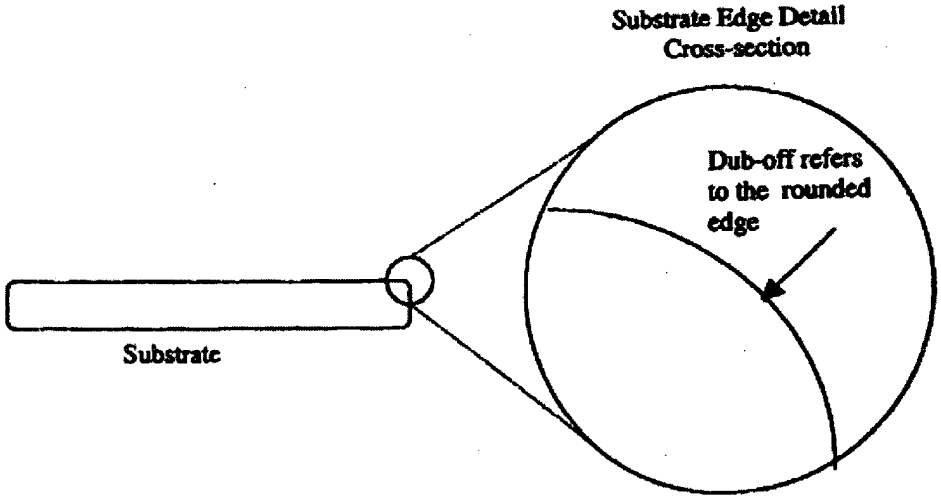


FIGURE 1B

Regarding to the height differential limitations set forth in claims 1 and 14-15, It would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized the range set forth in the claims since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

Regarding to claim 4, in col. 3, line 43, Baker discloses that the workpieces include semiconductor devices, etc. Thus, chemical etching is inherently employed in combination with CMP to process such workpiece.

Regarding to claims 8-10, the claims are directed to a result which are not given any patentable weights in the method claims; therefore, the method disclosed in the prior art is capable of producing such shape depending on changing process parameters such as polishing pressure, down force, and velocity.

Regarding to claims 11-12, groove (preshaped asperities) and under polishing pad bump are well-known in the art to provide variable pad stiffness in order to achieve certain polishing conditions to obtain a desired polishing result. Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized these well-known features in order to achieve certain polishing conditions to obtain a desired polishing result.

Regarding to claims 17- 18, the microlens array and optical fiber array connector set forth in claims 17- 18 is the intended workpiece, that is how the limitations further limits the method claim; thus they carry no patentable weights. The method disclosed in the prior art is obviously capable to produce such result.

Response to Arguments

Applicant's arguments filed March 03, 2005 have been fully considered but they are not persuasive. Applicant pointed out that the reference workpiece at the end of the CMP is low flatness and low roughness; therefore, not at least partially non-planar. This is true because in Table 1 the reference showed an improvement over the prior art in roughness and waviness. But nevertheless, the result shows a final product that is at least partially non-planar.

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Goosen et al.'5,170,455 discloses a method of micromachining microlens array. Hawkins et al.'5,711,890 and Mikolas'PGP2003/0136759 all disclose a CMP method of making imager. Japanese Patent Publication'62-83335 disclose a blasting method of making microlens array.

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Nguyen whose telephone number is 571-272-4491. The examiner can normally be reached on Monday-Friday/630AM-300PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Hail can be reached on 571-272-4485. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GEORGE NGUYEN
PRIMARY EXAMINER

George Nguyen
Primary Examiner
Art Unit 3723

GN – April 24, 2005

04/24/05
GN
approved

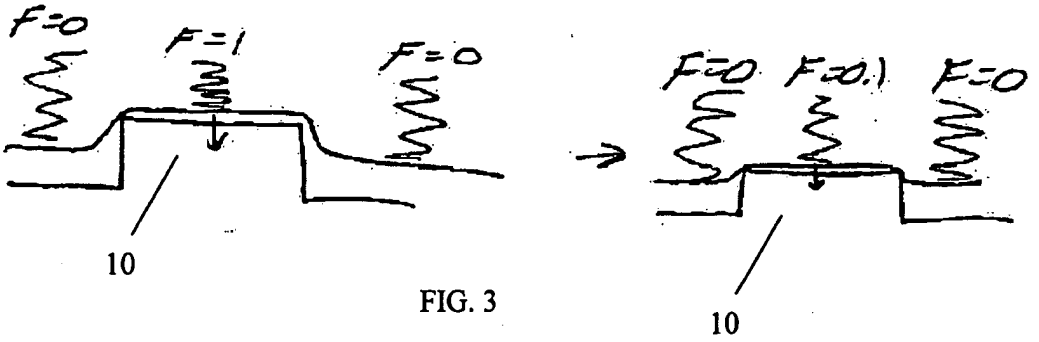


FIG. 3

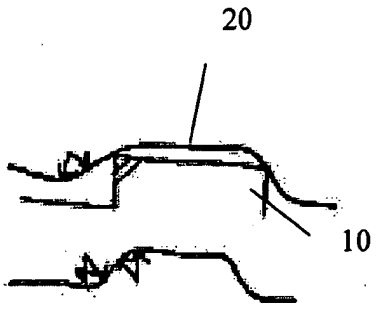


FIG. 4

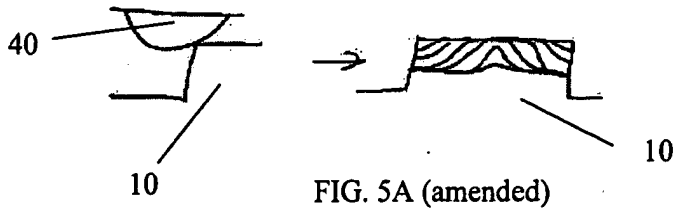


FIG. 5A (amended)

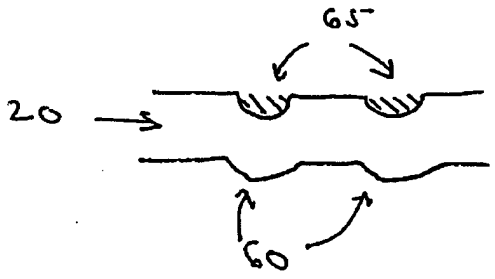


FIG. 5B (new)